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Space Transportation System and MDAC Payload Assist Module - Delta Class

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PAYLOAD INTEGRATION PLAN

NASA SPACE TRANSPORTATION SYSTEM

AND

MDAC PAYLOAD ASSIST MODULE - DELTA CLASS

MARCH 28, 1979

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NASA/JSC, SPIDPO

3-28
C. A. Ordahl
Program Manager
Thor/Delta & PAM Programs

PREFACE

This Payload Integration Plan (PIP) represents the payload-to-Space Transportation System (STS) agreement on the responsibilities and tasks that directly relate to the integration of the Payload Assist Module (PAM-D) into the STS, and includes a definition of tasks that the STS considers optional services.

This PIP includes only the tasks and agreements pertinent to the development of the baseline PAM-D.

Further understanding of the STS operations and the associated payload unique requirements may indicate the need for optional services. This can be accommodated by amendment of the PIP.

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1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA), and McDonnell Douglas Astronautics Corporation (MDAC) plan to launch several Delta Class Payload Assist Modules (PAM-D) to boost spacecraft to geosynchronous altitude from the NASA Space Transportation System (STS).

For purposes of this Payload Integration Plan (PIP), the STS shall be represented by the NASA-Johnson Space Center (JSC) and the NASA-Kennedy Space Center (KSC). The Payload Assist Module-Delta class (PAM-D) shall be represented by McDonnell Douglas Astronautics Corporation (MDAC).

This PIP provides the management roles and responsibilities, and definition of the technical activities, interfaces, and schedule requirements to accomplish the integration of the PAM-D with the STS.

This plan deals only with the STS/PAM-D interfaces and agreements relative to the development phase of the baseline PAM-D program. Mission peculiar hardware and services for the users mission are not discussed herein and are provided for directly from MDAC to the STS user or his spacecraft contractor. Mission operational requirements are not included herein since they will be negotiated between NASA and STS User. The total requirements for the baseline PAM implementation are contained in this plan, its annexes, and the STS/PAM-D baseline Interface Control Documents (ICD).

2.0 MANAGEMENT RESPONSIBILITIES

The responsibility for assuring the definition, control, implementation, and accomplishment of the activities identified in this document for the STS is vested with the Shuttle Payload Integration and Development Program Office (SPIDPO) at NASA-JSC and for the PAM-D with MDAC. Changes to this document and associated documentation, including baseline ICD's created by this Payload Integration Plan shall be mutually agreed to and signed by the SPIDPO and MDAC.

2.1 Joint Responsibilities

STS and MDAC will support the required baseline PAM-D integration activities, both analytical and physical as identified in this plan and according to the schedules contained herein.

The STS and MDAC have the technical responsibility for defining the baseline PAM-D/STS integration requirements and documenting them in the appropriate annexes to this PIP. The STS and MDAC are also responsible for the technical definition of the PAM-D/STS interfaces and their documentation in the PAM-D/STS ICD. Telecons and meetings supporting these activities will be coordinated and scheduled with MDAC by NASA.

2.1.1 Documentation.- The primary documentation to insure proper integration of the payload will consist of the PIP, the PIP annexes, and appropriate ICD's. These documents and associated changes will be jointly approved by STS and MDAC. Configuration control will be initiated upon signature approval. NASA/JSC will maintain configuration control of the above documentation in accordance with Change Control Requirements and Procedures Manual JSC 13995, with the exception of the Launch Site Support Plan Annex which will be maintained by KSC in accordance with (no.) plan.

2.2 STS Responsibilities

NASA/JSC is responsible for integration of the PAM-D into the STS including analytical and physical integration, integrated flight design, integrated flight operations prior to deployment, and compatibility with other cargo elements which share the same flight.

NASA/KSC Payload Project Office is responsible for the STS launch and landing support, for agreed upon facilities and services required for integrated checkout, and for ground integration of the PAM-D and STS.

The Goddard Space Flight Center (GSFC) is responsible for monitoring the PAM-D development program in consonance with the NASA MDAC SSUS-D agreement.

2.3 MDAC Responsibilities

MDAC is responsible for the design, development, and test of the STS PAM-D system and for specific analyses in support of integrating the baseline PAM-D system into the STS Orbiter. MDAC is also responsible for supplying NASA the basic flight and ground operations input data applicable to the baseline PAM-D. MDAC will also provide general baseline data for use by NASA and its contractors in support of general cargo integration. Prior to receiving MDAC proprietary data from NASA a contractor must agree in writing as to protection and restrictive use of the data.

3.0 PAM-D SYSTEM DESCRIPTION

The MDAC PAM-D is a spinning solid upper stage (SSUS) system consisting of a reusable cradle which attaches to the Orbiter longerons and keel, a reusable spin table attached to the cradle to impart rotation to the PAM and its attached spacecraft, and a solid rocket motor and the payload attach fitting system for mounting the spacecraft. Associated with the cradle assembly are the PAM-D required control and monitor equipment. The cradle assembly, spin table system, and control hardware remain with the Orbiter after the PAM expendable hardware with its spacecraft are ejected from the Orbiter. The PAM system with spacecraft envelope are shown in Figures 3-1 and 3-2.

4.0 MISSION OPERATIONS

The baseline PAM mission operation constraints by mission phase are delineated in this section.

PAM-D TO ORBITER MECHANICAL INTERFACE

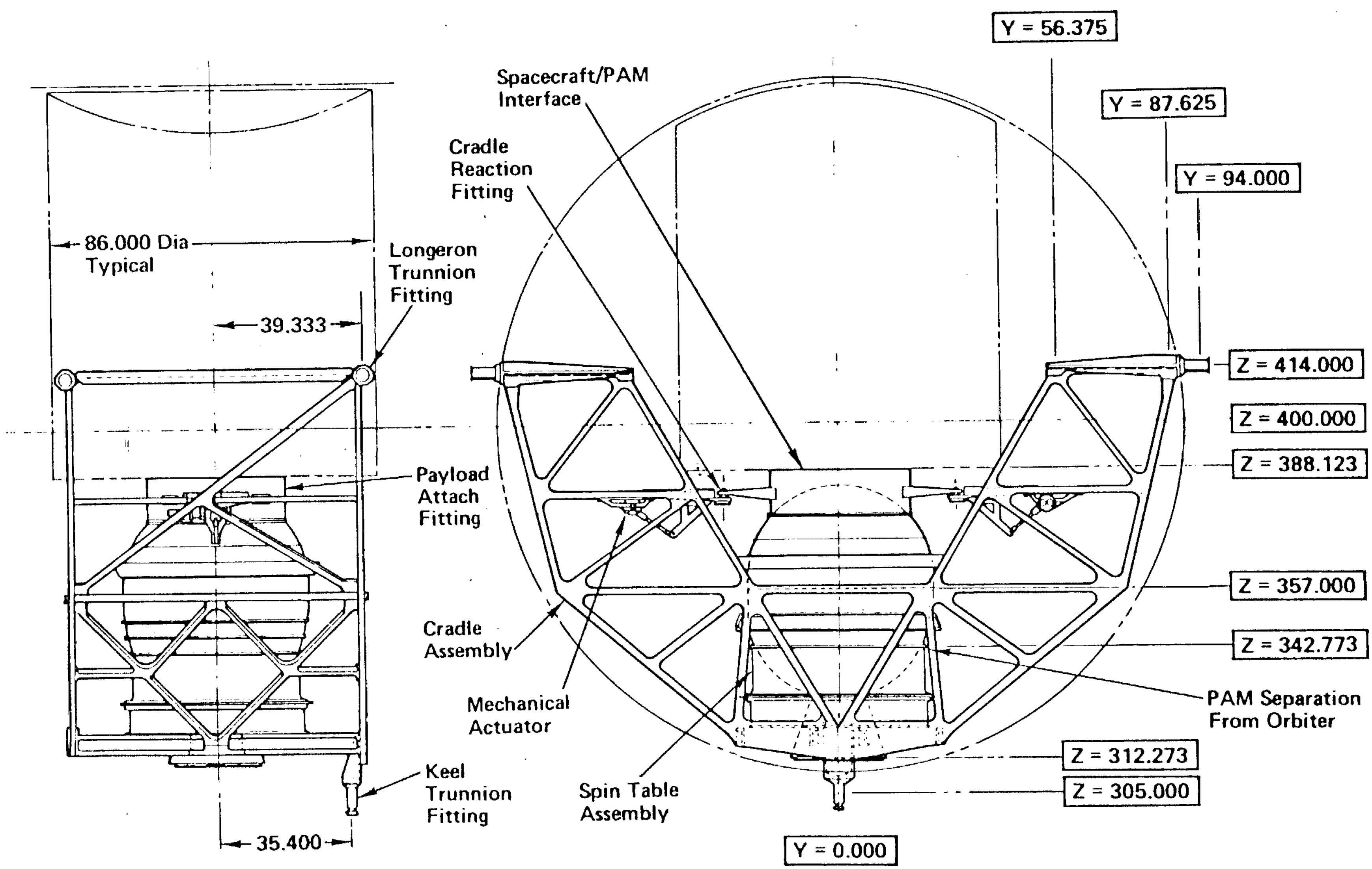


FIGURE 3-1

PAM-D THERMAL CONTROL SYSTEM

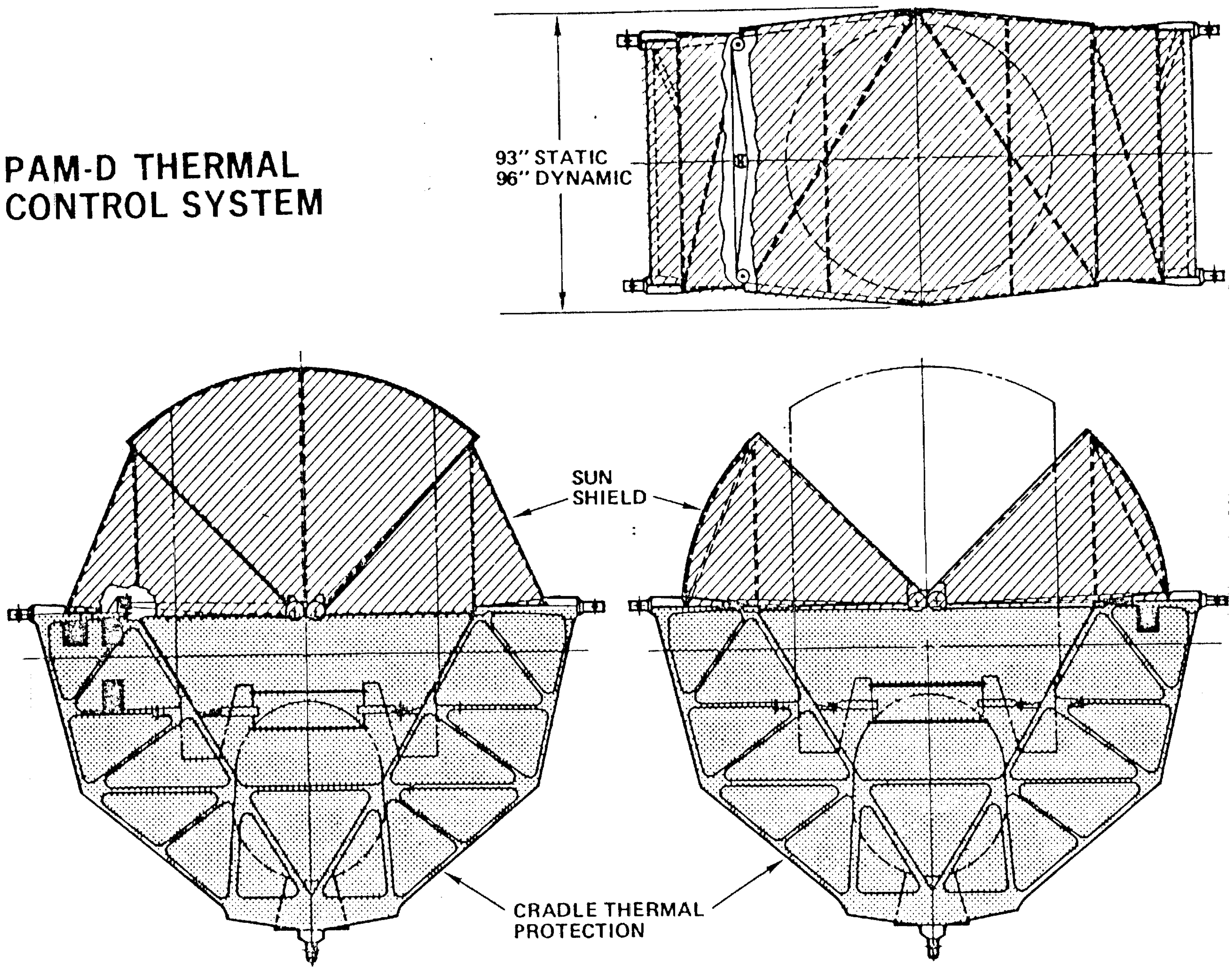


FIGURE 3-2

4.1 Preliminary Mission Scenario

The STS Users completely assembled and checked out spacecraft will be mated with the PAM-D system at the launch site prior to delivery to NASA at either Cape Canaveral Air Force Station (CCAFS) or Kennedy Space Center (KSC). The spacecraft/PAM interfaces will be verified prior to handover to NASA. The PAM-D and spacecraft (assembly) will be provided to the NASA at the Vertical Processing Facility (VPF) for NASA prelaunch verification in the Cargo Integration Test Equipment (CITE). The assembled cargo will then be transferred to the launch pad for installation in the payload bay. Once installed in the payload bay, the electrical connections between the assembly and the Orbiter will be made and the interfaces verified. The STS will be responsible for controlling all integrated Orbiter/PAM-D flight operations.

After launch, when the Orbiter has attained the required orbit and the sunshield closed, the Orbiter payload bay doors will be opened. When ready to eject the PAM-D, the Orbiter will perform an IMU alignment, if required, and maneuver to the PAM-D/spacecraft deployment attitude. The PAM-D control and monitor equipment will be actuated by crew command, and a self-check program will be automatically implemented. The PAM-D restraint mechanism will be retracted, the sunshield opened, and the spin table activated to spin up the PAM/spacecraft combination to the required spin rate. The PAM motor will be armed by manual command while in the Orbiter cargo bay. Upon Orbiter flight crew confirmation of proper state vector the separation/deployment system will be commanded and the spring system will separate the PAM-D/spacecraft combination from the Orbiter after which the sunshield will be closed. Forty-five minutes after separation, the PAM motor which will place the spacecraft into geosynchronous transfer orbit will be ignited. The final separation of the spacecraft from the PAM-D will occur shortly thereafter by signal from the PAM-D sequencer. Approximately 2 seconds after spacecraft separation from the expended PAM-D hardware, the PAM-D tumble system yo-weight will be released to tumble the expended PAM motor/ PAM combination, thus preventing recontact with the spacecraft. Subsequent command and control of the spacecraft will be accomplished by the spacecraft users ground facilities or on board spacecraft systems.

4.2 Orbital Requirements and Payload Control Parameters

Orbit altitude	160 NM $\pm$ TBD NM	
Eccentricity	Circular $\pm$ TBD	
Inclination	28.5°	
Control Weight	Expendable PAM-D + ASE	7162 lbs
	Design reference payload	2750 lbs

Maximum payload control length including dynamic and access clearances = 96 inches.

The term "control weight" and "control length" as used in this PIP is the limit weight or length which the payload may not exceed without STS concurrence.

(PAM-D) sequenced mass properties and configuration drawings will be provided by MDAC as part of Payload Data Package Annex.

4.3 Operational Requirements and Constraints

The following (PAM-D) operational requirements and constraints will be used in the flight planning and implementation of the STS and PAM-D mission.

4.3.1 Prelaunch.- Prior to cargo bay door closure on the pad, all PAM-D RF transmitters will be turned off.

4.3.2 Ascent.- Power is required throughout ascent.

4.3.3 On-orbit.- The cargo bay doors should be assumed to be opened no sooner than 1 hour after launch and no later than 3 hours after launch. If the doors are not opened by 3 hours after launch, the Orbiter will return and landing will be completed by launch plus 6.5 hours. For abort descent and landing, the payload shall be designed so that the resulting thermal conditions present no hazard to the Orbiter or crew. For flight contingency landing sites, no ground purge capability of the payload bay will exist.

4.3.3.1 Thermal Environment: The STS will normally be oriented with the cargo bay facing Earth (+ZLV) with multiple allowable excursions of solar viewing (+ZSolar), deep space viewing (+ZSpace), Earth viewing (+ZLV) as shown in the table below. Also specified are the payload recovery times for these excursions which allows repeat of the required attitudes.

Table 4-1

β ANGLE $<$ 60^{0} ATTITUDE REQUIREMENT

Attitude	Required time	Payload recovery time @ +ZLV
+ZLV	Continuous	N/A
+Z Solar	30 minutes	TBD
+Z Space	90 minutes	TBD
Payload Worst Solar Angle	TBD	TBD

Airborne support equipment remaining in the cargo bay after deployment of the payload shall be compatible with the Orbiter attitude capability as defined in paragraph 6.1.1.2 of ICD 2-19001. However, this requirement shall not require an active cooling system. In the event of failure to eject due to a PAM-D problem, the STS attitudes will be inhibited only by PAM/spacecraft safety constraints.

4.3.3.2 Command/Telemetry: For on-orbit attached checkout TBD minutes of SCA data are required to be down linked no later than two hours prior to ejection. The airborne support equipment command and data interface is discussed in sections 5.3 and 5.4.

4.3.3.3 STS/PAM-D Deployment Timing and Pointing: The Orbiter as referenced to the plane of the payload longeron/cradle interface will be oriented within 2 degrees of the payload specified inertial deployment attitude. The STS will deploy the PAM-D within ±2 seconds of the specified deployment time.

The accuracy of the knowledge of the orbit parameters will be within those defined in table 4-2.

TABLE 4-2 ORBITER STATE VECTOR

	POSITION, FT (M)			VELOCITY, FPS (M/SEC)		
	RADIAL	INTRACK	CROSS TRACK	RADIAL	INTRACK	CROSSTRACK
STATE VECTOR	4,291	34,450	4,291	38.4	5.9	9.8
UNCERTAINTY AT DEPLOYMENT	(1,500)	(10,500)	(1,500).	(11.7)	(1.8)	(3.0)

4.3.3.4 STS/PAM-D Separation: The PAM-D-provided linear separation rate from the STS shall be no less than 2 feet per second and the perigee motor ignition shall occur 45 minutes after deployment. Maximum angular rates of the Orbiter at time of ejection shall not exceed .01 degrees/second about any axis.

The standard Orbiter separation maneuver will be designed to minimize RCS plume impingement on the payload, consistent with achieving a safe separation distance.

4.3.3.5 Photographic Coverage: Photographic coverage of the spacecraft deployment and separation from the STS will be accomplished by the flight crew.

5.0 PAM-D-TO-STS INTERFACES

The STS mechanical, electrical, avionics, and environmental interfaces are defined in ICD 2-19001 with which the PAM-D must be compatible. STS to PAM-D interfaces are specified in ICD 2-. The cargo bay electrical and fluid interfaces, except for the RF interface, are physically located above the Z_0 400 station at or near the trunnion interface. See functional schematic Fig. 5-1.

5.1 Structural/Mechanical Interfaces

The PAM-D-to-STS adapter consists of a cradle (Fig. 1) which is attached to Orbiter payload bay attach fittings. The cradle is oriented so that the PAM-D expendable vehicle thrust axis is 90^{o} to the Orbiter longitudinal centerline. The cradle attachment interface consists of 4 trunnion fittings at the Orbiter longerons and one trunnion at the Orbiter keel. The expendable PAM-D vehicle (including spacecraft) separates from the Orbiter attached ASE at a plane at the top of the spin table. The PAM electrical ASE and spin system is attached to the PAM cradle. The electrical interfaces are located above Z_0 400 on the PAM-D cradle at the MDAC connector plate. NASA shall supply wiring in the standard wiring harness between the MDAC connectors and the Orbiter system. See functional schematic Fig. 5-1.

5.2 Cable Interfaces

The PAM-D will use 1 section of the standard AFD and payload harnesses in accordance with the mixed user allocations section of JSC 07700, Volume XIV.

Specific wiring pin function assignments will be defined in the STS/ PAM-D ICD A-14005.

5.3 Display and Control Interfaces

Display and control functions are accomplished using the following crew-controlled equipment:

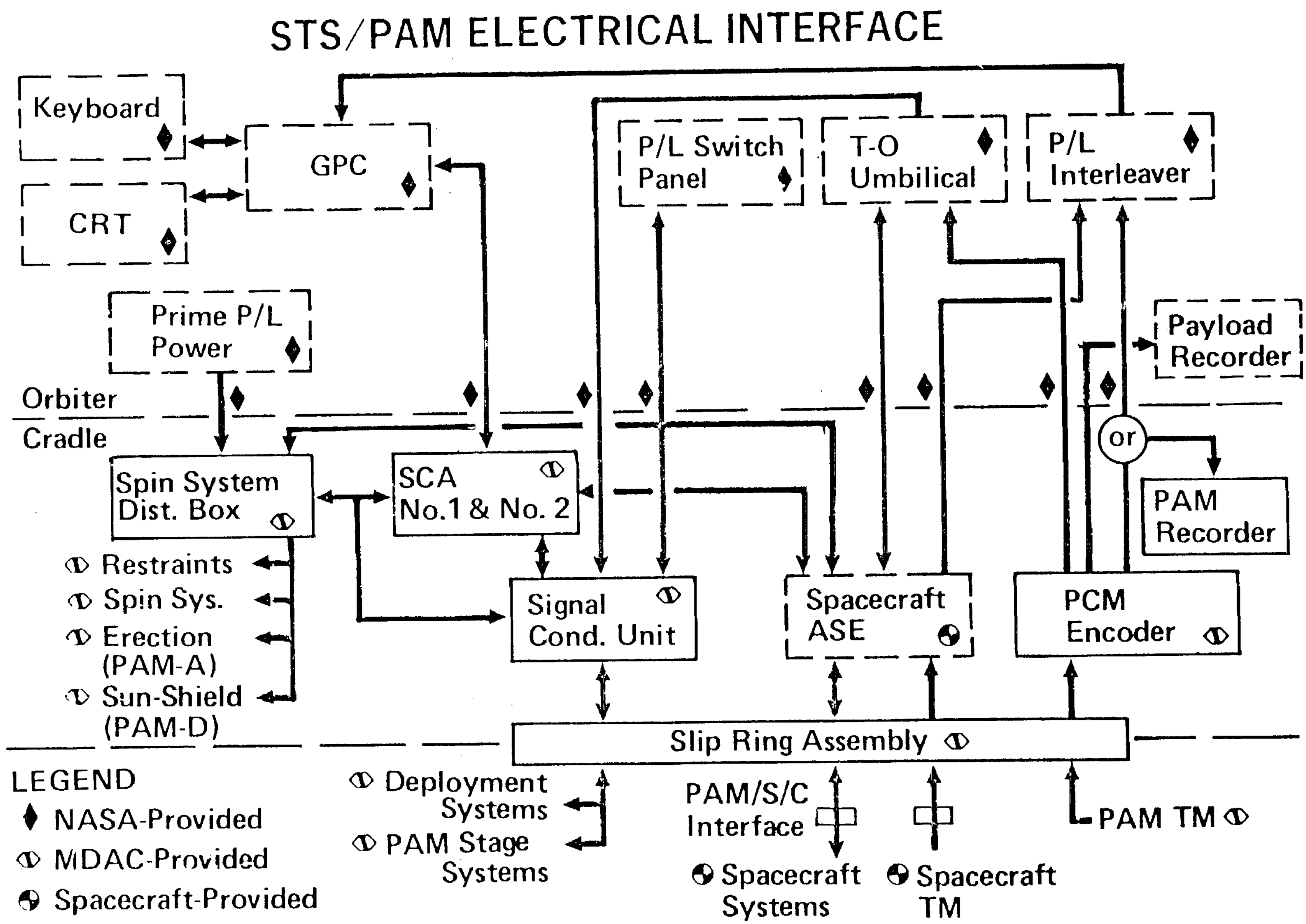
____1____ Section of the Standard Switch Panel

Requirements for display and control functions accomplished using the Orbiter general purpose Computer/Keyboard/CRT combination are to be defined in the Command and Data Annex to this PIP.

5.4 Electrical Power Interfaces

For PAM-D ground operations prior to installation in the STS, power will be supplied to the PAM-D using payload-provided electrical ground support equipment. During the STS/PAM-D ground and flight-mated operations, power will be supplied by the STS as defined in the following paragraphs.

In addition, payload provided electrical ground support equipment will be utilized for PAM-D battery trickle charge until payload bay closeout during the prelaunch activities. Electrical power interface requirements are as follows:



STS/PAM ELECTRICAL INTERFACE
Keyboard
CRT
GPC
Prime P/L Power
P/L Switch Panel
T-O Umbilical
P/L Interleaver
Payload Recorder
Orbiter
Cradle
or
PAM Recorder
Spin System Dist. Box
SCA No.1 & No. 2
Signal Cond. Unit
Spacecraft ASE
PCM Encoder
Restraints
Spin Sys.
Erection (PAM-A)
Sun-Shield (PAM-D)
Slip Ring Assembly
LEGEND
NASA-Provided
MDAC-Provided
Spacecraft-Provided
Deployment Systems
PAM Stage Systems
PAM/S/C Interface
Spacecraft Systems
Spacecraft TM
PAM TM

FIGURE 5-1

Power Source	Prelaunch	Launch	Payload Deployment Sequence Prior To	During	After
a) Orbiter bus	X (240)W Contd. 620 PK	X (110)W*	X 650 W 1.41 KW PK	1.85 KW 30 min 2.78 PK 7 min	TBD
b) Hardwire through T-0 Umbilical	(TBD)W	N/A	N/A		N/A

The specific power profile will be defined in the Flight Planning Annex.

* PAM only. Spacecraft requirement to be in user PIP.

5.5 Command Interfaces

The command interfaces are:

Payload Deployment Commands Interface/Source	Prelaunch	Launch	Payload Deployment Prior To	After
a. Hardwire through T-0 umbilical	X	N/A	N/A	N/A
b. GPC to data bus to SCA	X	N/A	X	X
c. Hardwire from Standard Switch Panel	X	N/A	X	X

5.6 Telemetry and Data Interfaces

Data and telemetry interfaces are as follows.

Data Interface/Route	Prelaunch	Launch	Payload Deployment Prior To	After
a) Hardwire through T-0 umbilical	X	N/A	N/A	N/A
b) Hardwire to payload data interleaver (Spacecraft	X (Kbps)	X (Kbps)	X (Kbps)	N/A
c) PI (RF) to Payload Data interleaver (Spacecraft Use)	N/A	N/A	N/A	X (Kbps)

d)	Hardwire to Orbiter payload recorder *	N/A	X	X	N/A
e)	Data bus to GPC	X (Kbps)	X (Kbps)	X (Kbps)	X (Kbps)

* Data to be recorded on the Payload recorder shall be 2 channel digital data stream from 32 to 64 kbps and an analog channel for frequencies from 1.9 KHz to 125 KHz.

Engineering characteristics are defined in the PAM-D/STS ICD and the link parameters are defined in the Command and Data Annex.

The phased sequence of operational usage of the data systems will be specified in the Flight Operations Support Annex.

5.7 Fluid Interfaces

None

5.8 Software Interfaces

The payload uses the standard software services as defined in JSC 07700 vol XIV.

6.0 ENVIRONMENTAL ANALYSIS AND INTERFACES

Standard Shuttle/payload natural and induced environmental interfaces including structural loads, thermal, contamination, shock, vibration and acoustics are contained in the Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001.

Environmental interface analyses will be conducted to determine physical and functional interface compatibility of the PAM-D and STS. The specific analyses are described in the following paragraphs.

6.1 Structural Loads and Deflections

Definition and control of the structural loads environment will be documented in the baseline PAM-D/STS ICD.

The loads analysis will be performed by MDAC using the NASA supplied updated STS model and forcing functions as scheduled in section 15. STS will be provided the results of this analysis of the PAM-D in accordance with section 15. These results will contain:

A. Dynamic response analysis output includes all output required for Quasi-static analyses plus the following:

    1. Max/min accelerations at selected cargo node points.

2. Time history plots of the following

   A. STS/cargo interface forces

   B. Cargo load factors

   C. Acceleration at selected cargo node points.

   D. Modal contribution of acceleration at selected node points.

B. Modal data on magnetic tape or punched cards as required by STS

   1. Modal deflections, Modal frequencies, and generalized mass and stiffness.

      A. For the PAM-D system

      B. For the coupled PAM-D/STS system.

   2. ASE/STS coupling equations

   3. Load/Deflection transformation matrix

NASA will verify the results of the MDAC baseline analysis by independently computing responses and loads for a limited number of conditions.

Updates to the STS dynamic model and/or forcing functions due to Shuttle tests and analyses will be furnished to MDAC by NASA. These updates will be used by MDAC in performing mission specific coupled dynamic analyses for users of the STS-PAM-D system. Anticipated updates are indicated in the schedule. MDAC is responsible for assuring structural compatibility of the PAM-D with the Shuttle loading environment as defined in the STS verification loads cycle.

MDAC will also provide overall baseline mass properties and general configuration drawing to the NASA-JSC as a part of the Payload Data Package Annex to this PIP.

6.2 Thermal Environments and Interfaces

MDAC is responsible for the design and analysis of the payload to assure compliance with the thermal and attitude constraints defined in Section 4.0. The STS will furnish Orbiter thermal models to the MDAC. Results of supporting design analysis accomplished by the MDAC will be documented in a PAM-D/STS thermal report and provided to the STS. This report will be discussed by the joint working groups to assure understanding and agreement. Thermal models and updates including critical nodes and temperature limits for these nodes shall be furnished by the MDAC to STS. STS will then perform an integrated cargo thermal analysis consistent with jointly agreed upon flight conditions to support the cargo integration review. The schedule for furnishing the various PAM thermal models and results of the integrated analyses are contained in section 15. All models, analyses, and reports will be in accordance with document (ES - TBD). The results of the verification thermal analysis will be used by the STS to assure that the resulting thermal environment is compatible with the Orbiter and other cargo elements. MDAC is responsible for verifying the payload's compatibility with this environment.

6.3 EMI/EMC

MDAC is responsible for assuring that the PAM-D interfaces meets the induced EMI environment and complies with the radiated requirements defined in ICD 2-19001. The specific characteristics of the payload radiation sources will be defined in the Payload Data Package Annex according to the schedule defined in section 15. The STS will perform an intentional-radiator RF interference assessment for mutual compatibility as a standard service. However, the payload retains the responsibility for assuring that his payload operates properly in the anticipated environment. Payload intentional transmitter radiated levels outside the payload envelope incident on other cargo elements within the cargo bay shall be limited to those levels defined for S-band in ICD 2-19001.

6.4 Contamination

MDAC is responsible for assuring that the payload is compatible with the induced contamination environment and complies with the outgassing requirements as defined in ICD 2-19001.

6.5 Shock, Vibration and Acoustic Environments

MDAC is responsible for compatibility with the STS induced shock, vibration and acoustical environments defined in ICD 2-19001.

6.6 Ground Environmental Requirements

Load factors for ground handling and transportation hardware for the PAM-D shall not exceed those specified in the Launch Site Accommodations Handbook, K-STSM-14.1.

7.0 INTEGRATION HARDWARE

7.1 Test Hardware

MDAC will provide and support NASA with refurbished qualification test hardware at KSC as shown on the schedule for NASA-KSC verification of the interfaces between the PAM-D system and the STS. The PAM-D system will be of the representative weight and c.g. NASA shall be responsible for obtaining a simulated spacecraft, if required.

7.2 Flight Hardware

1. STS will supply the Standard Switch panel, and Aft flight deck and Cargo bay standard harness in the payload bay.

2. MDAC will provide mating connectors to the standard harness.

3. The hardware to install the PAM-D with attached spacecraft into the STS will be supplied by NASA.

8.0 FLIGHT OPERATIONS

This section defines the flight design, flight activity planning, flight crew and flight controller training and flight operations support activities required for PAM-D/STS integration.

8.1 Flight Design

The STS will be responsible for Orbiter flight design analysis from lift-off through ejection of the PAM and for subsequent Orbiter separation maneuvers. MDAC is responsible for the nominal PAM mission design analysis and for preparation of design trajectories from STS separation through spacecraft separation.

8.2 Flight Activity Planning

8.2.1 Crew Activity Plan.- The STS will be responsible for all crew activity plans and will develop an integrated summary STS/PAM-D crew activity plan to support the baseline PAM-D. Included in the plan will be the MDAC supplied sequence of events. MDAC will provide this sequence of events as part of the Flight Planning Annex.

8.2.2 Payload Operating Procedures.- MDAC is responsible for the development and verification of PAM-D operating procedures. These operating procedures are transmitted to the STS via the Flight Operations Support Annex of the PIP. These procedures will be used by the STS to generate the integrated STS/PAM-D procedures.

8.3 Training

The STS will be responsible for providing the crew training plans and crew training required for the STS/PAM-D. MDAC is responsible for providing a crew briefing for payload familiarization and for providing configuration data to support the above training.

8.4 Flight Operations Control

The STS will be responsible for integration of flight operations until the PAM-D is a safe distance from the Orbiter. The STS flight control operations will be conducted from the NASA-JSC Mission Control Center (MCC) using the Spaceflight Tracking and Data Network (STDN) network. The basic plan, timelines and agreements for these operations including necessary procedures will be identified in the Flight Operations Support Annex.

9.0 LAUNCH AND LANDING SITE SUPPORT

The KSC SSUS Manager (LSSM) receives/coordinates the MDAC launch and landing requirements and documents a formal KSC MDAC Launch Site Ground Operations Plan (PIP Annex-8).

MDAC will retain prime responsiblility for test, checkout, servicing operations, etc. of the PAM-D while in the PAM Processing Facility. All integrated activities will be the responsibility of the appropriate STS organization.

9.1 Delta Spin Test Facility (DSTF)

Check out of the PAM-D system by MDAC will normally occur in the DSTF.

9.2 Vertical Processing Facility (VPF)

MDAC is responsible for moving the hardware to the VPF. It will be moved through the airlock, rotated to the horizontal position, and fit checked in the work stand. A system functional verification test will be performed by NASA in the CITE test facility. MDAC will support the verification process as called for in the PAM-D Launch Site Ground Operations Plan.

9.3 Pad Operations

NASA may, at its option, use the paragraph 7.1 hardware to perform handling and checkout verification in the RSS and with the Orbiter.

9.4 Post Flight Services and Disposition

The MDAC cradle assembly and all MDAC associated ASE and GSE will be removed by NASA and returned to MDAC.

10.0 SAFETY

MDAC is responsible for assuring that the PAM-D, its ASE, and its GSE (ground support equipment) are safe. The PAM-D and GSE shall be designed to comply with the requirements of NASA Office of Space Flight document

"Safety Policy and Requirements for Payloads Using the Space Transportation System," latest issue. To assess compliance with the safety requirements a maximum of 3 safety reviews for the payload, ground support equipment, and ground operations safety will be conducted by the STS in accordance with JSC 13830, "Implementation Procedure for STS Payload Safety Requirements," undated. The GSE and ground operations safety reviews will be coordinated/scheduled by the KSC LSSM and may be held in conjunction with the flight safety reviews or ground operations meetings.

The safety documentation required to support each safety review will be provided to the appropiate NASA organization (ground OPR KSC/LSSM, FLT OPS-JSC) by the payload organization 30 days prior to the scheduled safety review. The results of the safety reviews and assessments will be the safety certification of the PAM-D and GSE by MDAC prior to delivery and start of processing and installation in the Orbiter cargo bay. MDAC will submit a flight readiness statement to the user for subsequent transmittal to NASA.

11.0 INTERFACE VERIFICATION

The payload is responsible for verifying compatibility with the interfaces and environments specified in PIP and applicable ICD's. The non-safety associated interface verification requirements and planning will be negotiated and concurred in by the STS and MDAC. It is anticipated that this interface verification will be accomplished within the scope of normal test, checkout and integration flow of the PAM-D/spacecraft. Included within the flow at VPF is a Cargo Integration Test to verify pre-installation electrical and mechanical compatibility with the STS. The SCA to GPC interface will be verified in the Shuttle Avionics Integration Lab or other suitable method if the CITE does not have an adequate GPC simulator. MDAC and NASA shall each bear the cost of the use of its personnel and equipment or facilities required and for the preparation of jointly required test procedures. The interface verification requirements are specified in Volume XIV, PIV 01.

12.0 POST FLIGHT DATA REQUIREMENTS

None

13.0 OPTIONAL SERVICES

Optional services are TBD.

14.0 PIP ANNEXES

The following annexes are a part of this plan for the baseline PAM-D system. The required data wil be furnished by MDAC in accord with the NASA supplied format.

1. Payload Data Package (Mass properties, configuration drawing radiation data)

2. Flight Planning

3. Flight Operations Support

4. Command and Data

8. Launch Site Ground Operations Plan

15.0 SCHEDULE

The Figure 15-1 schedule provides a summary of the various technical areas requiring data exchange and/or products in support of the PAM/STS integration activities.

16.0 REFERENCE DOCUMENT

a. NASA OSF "Safety Policy and Requirements for Payloads Using the Space Transportaion System", (current issue).

b. Implementation Procedure for STS Payload Safety Requirements, JSC-13830.

c. STS/PAM-D Interface Control Document.

d. Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001, Revision F, Chg. No. 27, dated 9/22/78.

e. Space Transportation System Models Configuration Management/Control System and Standard Analyses for Payload Load Cycle, SD77-SH-0214, dated October, 1977.

f. KSC Launch Site Accommodation Handbook (K-STSM-14.1), current issue.

g. SPIDPO Change Control Requirements and Procedures Manual, JSC-13995, dated May 1978.

h. NASA MDAC Agreement for development of the SSUS-D

i. Shuttle/Payload Integration Activities Plan, JSC-14363.

j. Space Shuttle System Payload Accommodations, JSC-07700 Volume XIV, dated 22 Sept 78.

NASA-S-79-1341A

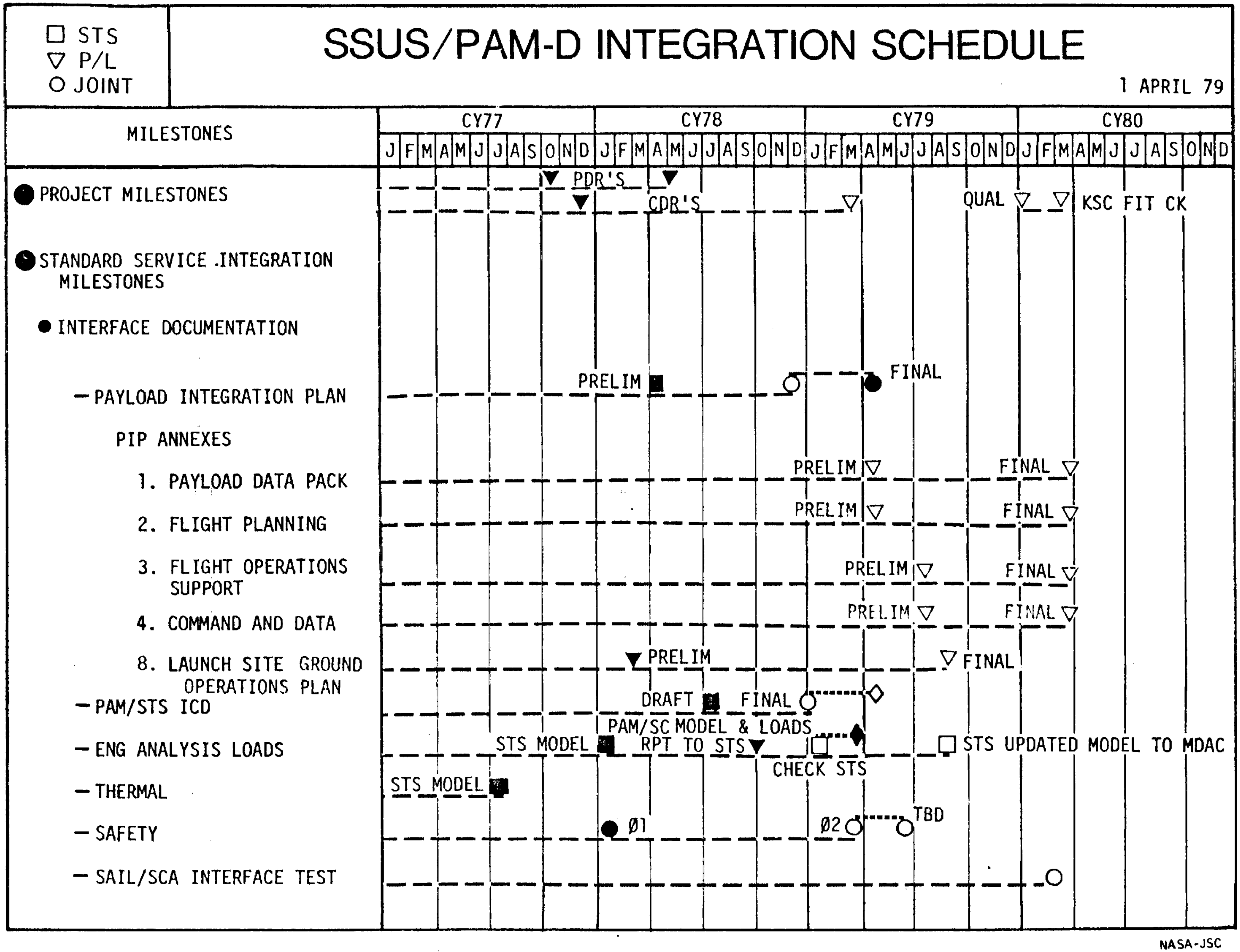


FIGURE 15-1